

MONEY DEMAND AND SEIGNIORAGE IN TRANSITION

by

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ABSTRACT

The major objective of the paper is to provide estimates of a money demand function and of the optimal seigniorage in the Czech Republic and compare it to other transition countries such as Bulgaria, Poland and Romania, and analyze the scope of budget deficit financing through money printing. To calculate the optimal seigniorage the steady-state condition is applied to the seigniorage maximizing rate of money growth. Hence, the discussion on using models of this type in a transition economy is an important part of the paper.

An inherent part of this analysis is an estimate of money demand functions. Besides standard methods such as OLS or instrumental variables the possibility of a simultaneous estimate of the money demand function for the Czech Republic with the function of a reference country through seemingly unrelated regression is considered. This approach removes seasonality in data without losing observations or freedom, and consequently improves the estimate.

The analysis shows that the interest rate started to play its role in the demand for money in spite of extensive use of direct measures in monetary policy and extensive credit rationing. It is emphasized that the Czech Republic applied restrictive fiscal and monetary policies with the pegged exchange rate as a nominal anchor during transition. This cannot be considered as a general framework for the transition period but it is possible because of the relatively stable macroeconomic situation and sufficient international reserves. The analysis confirms that Czech Republic does not tend to use seigniorage to finance its deficit.

ABSTRAKT

Článek se zabývá odhadem funkce poptávky po penězích a odhadem optimálního ražebného v České republice. Získané výsledky jsou porovnány s ostatními transformujícími zeměmi jako jsou Bulharsko, Polsko a Rumunsko. K výpočtu optimálního ražebného jsou použity modely pro optimální ražebné platící ve stabilních ekonomikách, a vhodnost těchto modelů pro transformující země je ve článku diskutována.

Nedělitelnou součástí článku je odhad funkce poptávky po penězích. Parametry poptávkové funkce jsou odhadovány metodou nejmenších čverců se zvolenými instrumenty a pomocí simultálního odhadu ("seemingly unrelated regression").

Analýza ukazuje, že úroková míra začíná hrát důležitou roli v poptávce po penězích. Mimo jiné se ukazuje, že Česká republika nepoužívá ražebné k financování svého dluhu.

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Introduction

The authors investigate a macroeconomic policy issue in the Czech Republic and some other transition economies. A special focus is on monetary and fiscal policies. The paper, however, is not restricted to a general description of the policies and macroeconomic development; it aims to provide a quantitative assessment of the relation between the rates of inflation and money growth.

The quantitative analysis is based on an estimate of the standard money demand function and on a model of seigniorage and money growth, roots of which can be found in the classical paper by Cagan (1956). We use the model with a modification that was applied by Christodoulakis and Alogoskoufis (1990) for Greece.

The paper starts with a brief introductory description of the macroeconomic development in the Czech Republic which is to make the reader familiar with the economic environment rather than to provide a detailed analysis. Some comments also referring to other transitional countries such as Bulgaria, Hungary, Poland and Romania are made; they show the main similarities and differences among these countries as far as macroeconomic paths and the pillars of the economic transformation are concerned.

The second part presents an approach to the analysis of national debt stabilization through seigniorage. A model for optimal seigniorage is presented in this section and its appropriateness for the transition economy is discussed. It determines the condition for the seigniorage maximizing optimal growth of money supply.

The third part is more technical; estimates of the money demand functions for the Czech Republic and other aforementioned economies are presented. Consequently, the role of interest elasticity of money demand in transition economies is discussed.

The fourth part is devoted to the interpretation of the results, that is to say, to the assessment of the relative sizes of seigniorage and of the possibility of using seigniorage to stabilize the national debt.

The final part summarizes lessons from the analysis.

1. Transition performance

Given unfavourable economic conditions and a sharp fall in output (see Figure 1), the Eastern European countries have exerted much effort to stabilize macroeconomic conditions and to undertake systemic reforms. In addition to a high degree of uncertainty, declining real wages, and restrictive macroeconomic policies, a sharp fall in demand occurred. This recession was amplified by the virtual collapse of intra-regional trade, reflecting mainly a contraction of import demand in the former USSR, the reorientation of the former East Germany import demand, and to some extent the spillover effects of weak economic activity throughout the region.

The output contraction has led to rapid growth in the unemployment rate in most transition economies (see Table 1). The Czech Republic was the only exception with an unemployment rate well below the critical level - it was about 3.5 percent at the end of 1993. Even the Slovak Republic, which was a part of the former Czechoslovakia till the end of 1992, suffers from unemployment totalling over 10 percent.

Table 1 Rate of unemployment, 1990-1992

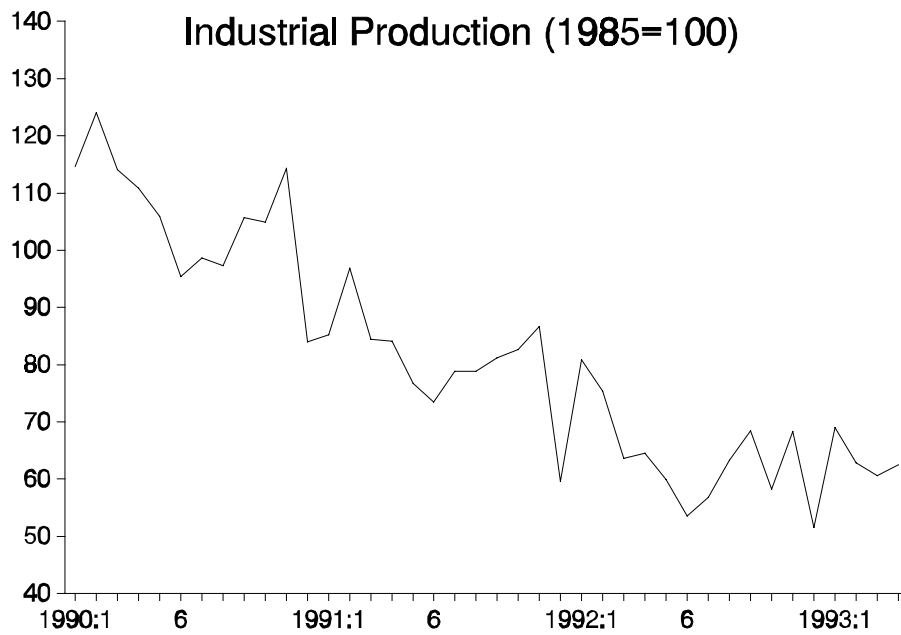
	1990	1991	1992
Czech Republic	0.8	4.1	2.6
Bulgaria	1.6	11.7	15
Hungary	1.6	7.5	12
Poland	6.1	11.5	15
Romania	.	2.7	9

Source: OECD, Czech Statistical Office

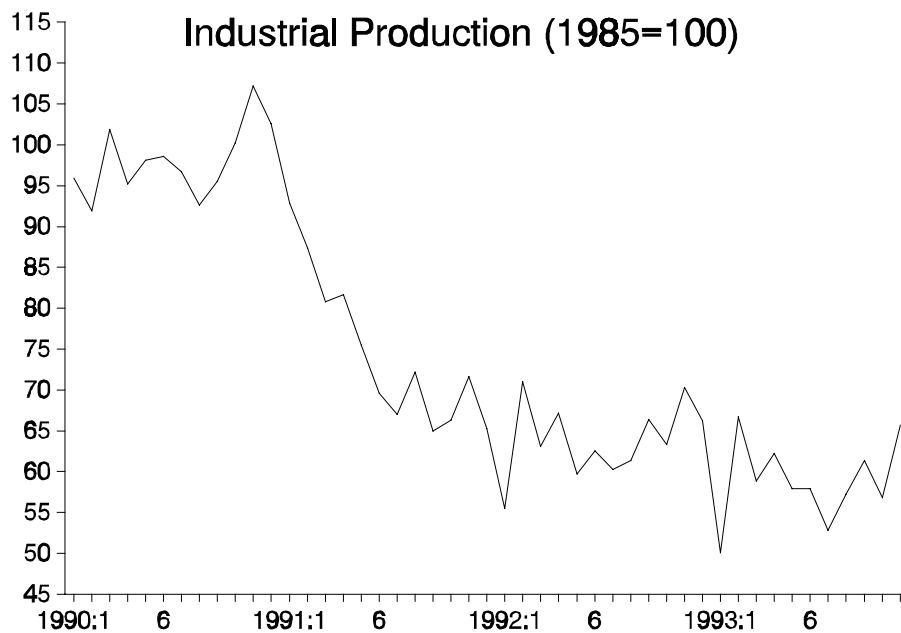
The high rate of unemployment is not only an economic problem; it can have direct social and political consequences. Thus, the issue of output growth is of great importance in the second stage of transition in all these countries. It is expected that the rate of unemployment will be pushed up in the Czech Republic during and after the privatization process.

Figure 1 Indices of industrial production for 5 selected countries

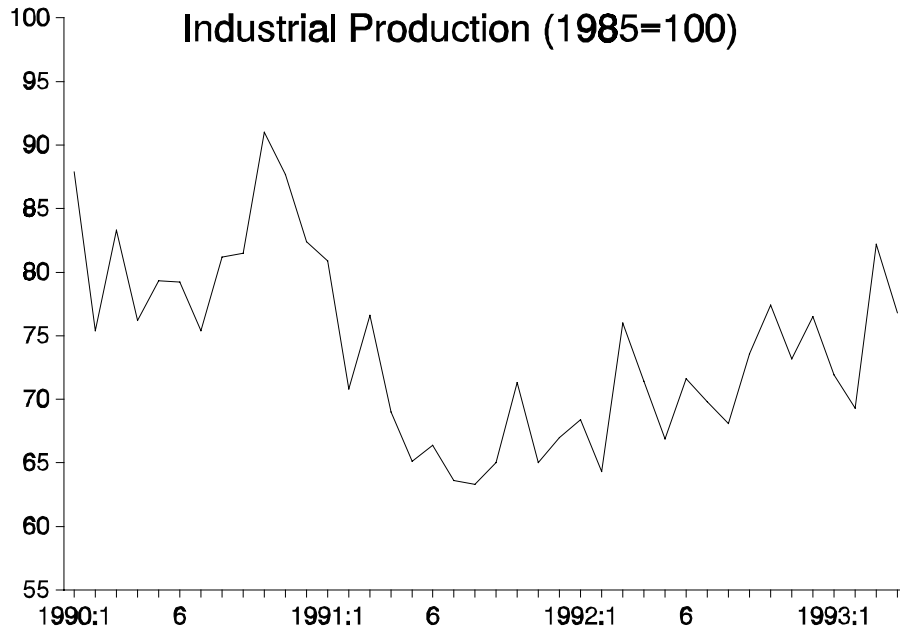
Bulgaria



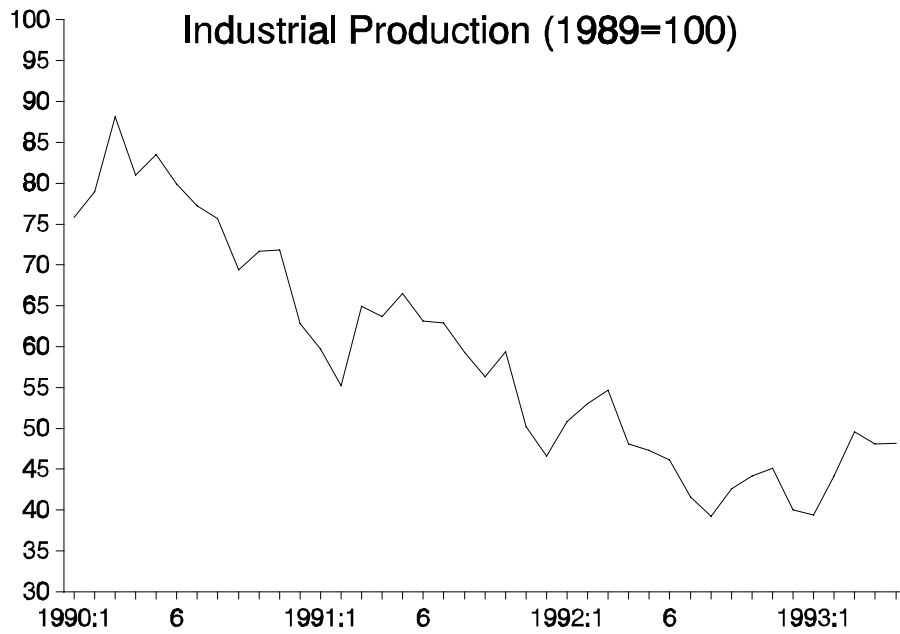
Czech Republic



Poland



Romania



According to the IMF programs, stabilization policies have rested on two main pillars: the reduction of fiscal deficits and the adoption of a tight monetary policy to restrict the growth of credit. All transition economies have aimed to create pressures on prices and the balance of payments. Furthermore, the Czech Republic (or Czechoslovakia) has fixed its nominal exchange rate as an anchor for curbing inflation.

Fiscal and monetary policies undertaken in these countries were not effective in all respects and their impacts differed across borders. Differences have arisen due to unequal starting conditions, lack of market structures, and backward financial systems. Nevertheless, an initial sharp decrease in the real money balances was reached through tight monetary policies and simultaneous price liberalizations in all countries.

The credit crunch and restrictive income policies prevented the economies from slipping into the wage-price spiral (except Romania where the rate of inflation does not look to be under control even in 1993). Thus inflation decreased significantly in subsequent months. Real wages fell in early 1991 as nominal wages were kept under control while prices rose sharply.

1.1. Czech Republic

After the political changes in Czechoslovakia (the Czech Republic being at that time a part of Czechoslovakia) at the end of 1989, it was agreed that fundamental changes which would shift the economic sphere towards the market structure should be introduced as soon as possible. In 1990 the basic program of these economic changes was announced and some preparatory steps were made: state planning was abolished, the discount rate was increased, commercial banks were separated from the State Bank of Czechoslovakia, some changes in the area of prices and indirect taxes were introduced, the exchange rate was substantially devaluated, etc.

In 1991 the main body of the reform was introduced. At the very beginning of the year, the restrictions on the prices of most commodities were lifted (as was announced in advance). Foreign trade was also liberalised, namely, the internal (or partial) convertibility of the Czechoslovak crown was established, resulting in the (almost) free access of citizens to foreign exchange. Small-scale privatization (the selling of small businesses to citizens in auctions) was launched as well as restitutions. The discount rate was increased again, followed by other interest rates, as a response to the jump in prices that occurred in January and February (a consequence of the price deregulation). After the

surprisingly quick stabilization of prices during the year, the discount rate was gradually decreased. The question of bad loans to inefficient state enterprises, one of the most difficult problems inherited by the new authorities from the previous era, was dealt with to some extent at the end of the year¹.

In 1992 large-scale privatization was begun with the emphasis on the voucher method, although less than half of the privatized property has been privatized through vouchers.² The voucher method was introduced because of a lack of domestic capital and also because of its appeal in terms of fairness. A large number of the privatised enterprises, however, made no effort to increase efficiency or restructure their production programs. An analysis of shifts in productivity by Lizal, Singer and Svejnar (1993) shows that there were no significant differences between the large state firms and smaller firms arising from the process of breaking up large firms. This analysis, however, considers only the effect of breaking the firms into smaller units (in the period 1990-1991) and not the effect of privatization itself.

The monetary policy has been targeted on two principal issues: curbing inflation and stabilizing the exchange rate. It is apparent that the Central Bank has chosen a very conservative policy - in periods of increasingly anticipated inflation, such as the price deregulation and the split of Czechoslovakia, it applies the tight monetary policy. In these periods, the real money supply declines. But, when the economy is stabilized, the monetary policy is mostly neutral or the rate of nominal money supply is almost the same as of the price level.

Rising uncertainty in the course of splitting the country and currency led to some squeeze in money supply in the first quarter of 1993. Afterwards, there was a clear tendency for monetary aggregates to grow. On average, the money stock (M2) increased by 16.7 percent in 1993, while PPI went up by 12.5 percent and CPI by 18.2 percent in the same period. In 1994, the Central Bank will, however, face new conditions emerging from the increased involvement of foreign investors. It is expected - and first signs could be observed already in 1993 - that foreign capital will be less reluctant to come into 'the transition area'. Furthermore, the Czech National Bank has been given an investment rating which invigorates the interest of foreign investors. It implies that changes

¹ The problem of bad debt and the related issue of interenterprise debt has not been solved yet. It is one of the most complicated problems which was hoped to be solved via bankruptcy procedures. There is a vast literature on this issue, see for instance, the proceedings from the conference on bankruptcies by the Institute for East-West Studies (1993).

² See Ceska (1993).

in money supply will be driven much more by the capital inflow than by domestic credits.

The exchange rate policy relies on a pegging regime, which means - with respect to the domestic and foreign rates of inflation - a gradual real appreciation of currency. This policy is sustainable on the condition that the Czech economy will exhibit increasing productivity and that the rate of inflation will approach the core which is estimated between 6-8 percent.³ In the near future, no changes in the real appreciation policy are expected and, in the medium term, the exchange rate stance may be influenced by the planned shift to the full convertibility of currency. The credibility of the Czech economic policy was reinforced by the government's attitude to its budget. It is a well-known fact that the Finance Ministry attempts to keep the budget balanced. But there are two reservations on this point.

First, some budget-type expenditures were covered by the National Property Fund.⁴ Even in 1994, the Fund is supposed to contribute 18 bn Kc to the budget revenues. It is argued, however, that the Fund's interferences are temporary and connected with the removal of communist heritage only. In other words, the debt and costs induced by failures of the CPE regime should be covered by privatization revenues.

Second, the state overtook the government credits that were provided - by order - by the Central Bank in the past. This represented over 60 bn Kc. Furthermore, the state covered the impact of the 1990 devaluations to commercial banks⁵, which added 26 bn Kc. Further still, the state bought-out Ceskoslovenska obchodni banka, contributing to the government's debt. The government also had to solve several similar problems. By and large, the debt of the Czech Republic was over 160 bn Kc, which was approximately 20 percent of GDP, when it came into existence on January 1, 1993.

The effort of the government is apparently focused on stabilizing the debt at this relatively low level. The government does not tend to use seigniorage or money printing to finance its liabilities. We will come back to this statement later when we put it through econometric analysis.

³ This estimate is by the JP Morgan Research Group.

⁴ The National Property Fund was established in 1991 to administer the national property and to privatize it in accordance with the approved privatization projects.

⁵ After recalculating liabilities and assets with the new exchange rate the commercial banks were worse off.

1.2. Similarities and Differences in Other Transition Countries

The Czech Republic had a special position among transition economies in the sense that its starting conditions were better than those of others. The pillars of the transition programs, however, were more or less the same in all these countries: tight monetary policy, deregulation of prices and of foreign trade, stabilization. Also external shocks, such as the break-up of COMECON trade, the world recession, the economic and political problems in the former Soviet Union and the Gulf crisis, hit these economies in a similar way. The main differences concentrated in the exchange rate regimes, the fiscal policy, and approaches to privatization as well as to bankruptcies.

With the exception of Hungary, all the aforementioned countries chose quick ways of price deregulation. It is often said that Hungary applies a gradualistic approach to transformation, but in our opinion this assessment is too simplified. There are differences in the speed and size of some measures but that does not entitle the observer to determine one approach as gradualistic and the second as shock therapy. For instance, the Czech Republic, which is labeled as the country running shock therapy, exhibits a 'friendly' social policy; there are huge subsidies even in 1993.⁶ Probably the most dramatic difference is in the speed and size of the privatization process. By and large, we do not consider dividing transition countries into two groups, with shock therapy and gradualistic approaches, to be helpful.

The exchange rate regime is largely determined by external indebtedness of the country, its international exchange reserves, and the rate of success in curbing inflation.

The only country that can afford the pegged exchange rate - at least for the time being - is the Czech Republic (Slovakia, which is not discussed in this paper, also inherited it from Czechoslovakia). It possesses enough foreign exchange and sufficiently low inflation. But - as we mentioned above - in spite of these positive factors the Czech Republic would be under strong pressure for devaluation if it did not manage to keep inflation around 10 percent in 1994 and less than 10 percent thereafter, and at the same time to increase productivity. Competitiveness has been declining due to inflation differentials since 1990 when three devaluations created a "buffer" for Czech exporters.

Poland enacted such a policy at the beginning of transition which kept the

⁶ The Czech authorities like priding upon the fact that 95 percent of prices have been deregulated. But looking at the representative consumer basket we find that at least 1/3 of the value of commodities included in the basket has been subsidized or regulated (rent, energy, water). This is our rough estimate.

nominal exchange rate fixed for 17 months whilst the price level for that period rose by 330 percent. It destroyed Polish competitiveness and forced a further devaluation. That's why Winiecki (1993) recommends keeping not the nominal, but the real exchange rate stable in the highly inflationary environment typical for transition economies.

Another common problem for countries in transition is indebtedness, mainly the external debt and its servicing. Table 2 shows that the debt/export ratios are too high to allow the economies to improve: exports will not spur growth but will only pay for the servicing of the debt. This does not hold for the Czech Republic and Romania. Both these countries 'owe thanks' for their favorable external position to the previous (communist) regimes. Romania, however, reached that result at the expense of even higher undercapitalization of the economy than was typical in other centrally planned economies, and at the expense of a huge drop in the standard of living.

Table 2 External debt and its ratio to exports, 1991-1992

	1991		1992	
	bn \$	debt/exports	bn \$	debt/exports
Czechoslovakia	9.4	0.8	9.7	0.9
Bulgaria	11.4	4.3	12.7	3.8
Hungary	22.7	2.3	21.4	2.2
Poland	48.4	3.4	47.0	4.1
Romania	1.1	0.3	2.4	0.6

Source: Bulletin of the Czech Statistical Office, 1993; OECD; International Financial Statistics

Note: We use the figures for Czechoslovakia here because dividing the debt before the end of 1992 into two parts, Czech and Slovak, would not make much sense.

If we look for comparison at fiscal and monetary policies in Bulgaria, Hungary, Poland and Romania we find that all of them fight huge fiscal deficits with

consequent pressures on the monetary stance. This refers to the foreign debt⁷ as well as to the national one. Therefore all governments in these countries strive for a settlement of the foreign debt problem and for better discipline in domestic budget policy. Mostly, however, they have not been very successful, which is largely determined by the absence of social and/or political consensus.

For instance, the political instability in Romania jeopardizes the continuity of the whole economic transformation. The new Romanian government, elected in September 1991, decided on a very unpopular increase in energy and other prices and announced steps towards a convertible currency, but the economic problems and a sharp drop in the standard of living contributed to a slower transition strategy with a gradual approach to price deregulation while preserving some ad hoc subsidies. From the stabilization point of view, the most dramatic failure is likely to be the monetary policy. The government has not succeeded in stabilizing either the exchange rate or inflation. The exchange rate underwent several abrupt devaluations, from 21.28 Lei/US\$ in the first quarter 1990 to over 830 Lei/US\$ at the end of August 1993. Furthermore, the government's attempts to slow down the pressure to depreciate the currency led to the draining of international reserves. The price level doubled in 1992 and accelerated further in 1993, which reflects the government's difficulties in stopping the growth of budget deficits: the government cannot collect sufficient revenues and tends to use seigniorage to financing its expenditures. Of all the discussed countries, Romania obviously uses the 'printing machine' most extensively.

A specific feature in Poland is the strong position of trade unions which leads to a 'wage maximization' policy being put forward by unions themselves and by some social groups⁸. On the other hand, the Polish economy looks to come into a recovery. The recovery is also heavily supported by the expansionary monetary policy - the real money growth was over 8 percent in 1992. Unfortunately, unemployment is still high regardless of the economy's growth, which can be explained - at least partially - by the restructuring of the economy.

These are the main features of transformation in individual transition economies. Going into the details of this description is beyond the scope of the paper, but an interested reader can find more general analyses, see e.g. Laki

⁷ In 1992, the Bulgarian debt was traded from 15 to 25 cents for 1 US \$ in the secondary markets.

⁸ This attitude is reflected not only in wage requirements but in other areas as well. Winiecki reports that nearly 50 percent of property in liquidation was not sold but *leased to employees* (Winiecki (1993), p. 37).

(1993), Nenova (1992) and Zielinski (1993) or some recent, yet-mimeo-type papers.

2. Stabilizing the Public Debt/GDP Ratio through an Increase in Seigniorage Revenue

We will now concentrate on one special issue - seigniorage in transition economies. Seigniorage⁹ is not typically a major source of revenue in an advanced economy, ranging mostly between 0.5-1.5 percent of GDP. To put it from another angle, it is a consequence of induced changes in the monetary base rather than a tool for financing a government's expenditures. A different situation can occur in countries with high and/or accelerating inflation where tax collecting is difficult. In such an inflationary environment, seigniorage can appear to be an important budget revenue.

Therefore, it is worth investigating the issue of 'money printing' in the transition economy. There are two points of view. First, one can be interested in the actual seigniorage revenues in these countries.¹⁰ Second, we can focus on the 'optimal' seigniorage in the transition economy; a consequent comparison of such an optimum with the actual seigniorage revenue provides a helpful insight into the monetary policy of a given country.

In this paper, we use the second approach. We are interested in whether or not the monetary authority chooses money growth lower than the optimum, or seigniorage maximizing, rate of money growth. The vital question, of course, is how to determine the optimum in the transition economy. One possibility is that we apply a steady-state model, although the transition economies are apparently far from the steady state. The argument for this approach is based on the fact that the condition for seigniorage maximizing money growth - as we will show below - depends crucially on the interest (semi-)elasticity of money demand. That is why the problem can be formulated as follows: Supposing the

⁹ We do not divert from the textbook concept of seigniorage here. By seigniorage we mean the real monetary base created. It implies that seigniorage is a revenue of the monetary authority (central bank) either directly from 'printing money' or from an increase in its liabilities with a corresponding change in its assets. For an explanation of the concepts of seigniorage in more detail see an economic textbook, e.g. Burda and Wyplosz (1993).

¹⁰ The development of monetary base in the Czech Republic is described in Izak, Klokocnik (1993).

estimated interest semi-elasticity holds also for the steady state, what is the optimal money growth? In other words, we believe that the *behavior* of the monetary authority and of the public in the transition economy does not have to differ dramatically from their steady-state behavior. Their decisions during the transition process already reflect tendencies or properties that are appropriate for the steady state.

The econometric analysis itself is the best verification of this approach. If the result were not significant, it could mean either a misspecification or that the behavior of the economy would not be consistent with the steady-state behavior. We exclude the first possibility because we do not think that it is worth looking for a special money demand function. On the other hand, comparing results - based on a 'standard' money demand function - of individual transition countries can give useful insight into their behavior and policies.

2.1. A model

The model we use goes back to Cagan's article¹¹ and is applied, for instance, to the case of Greece by Alogoskoufis and Christodoulakis (1990). Here we apply it to the Czech economy in the period 1990-1993 and for another three countries which serve basically as reference countries in this analysis¹².

To examine the path of seigniorage we need to specify the money demand function and define seigniorage. Let seigniorage as a percentage of output be

$$S_y = \frac{S}{Y} = \mu m \quad (1)$$

and demand for money

$$m = \frac{M}{PY} = c \exp(-\eta i) \quad (2)$$

where S represents seigniorage and Y output, μ is the rate of money growth, i denotes the nominal interest rate and η is the interest elasticity of demand for

¹¹ See the original article or the exposition in Blanchard and Fischer's *Lectures* (1989).

¹² Unfortunately, we have not managed to obtain a sufficiently reliable set of data on Hungary and Slovakia which we would like cover in this analysis.

money, and c is a constant term.

This functional form of the demand for money is applied under an implicit assumption that income elasticity is unitary. As we mention further in the text, a test did not enable us to reject the hypothesis on unitary income elasticity. Another possibility is to consider output to be given and then it could be a part of the constant term; for this exposition, see Blanchard and Fisher (1989).

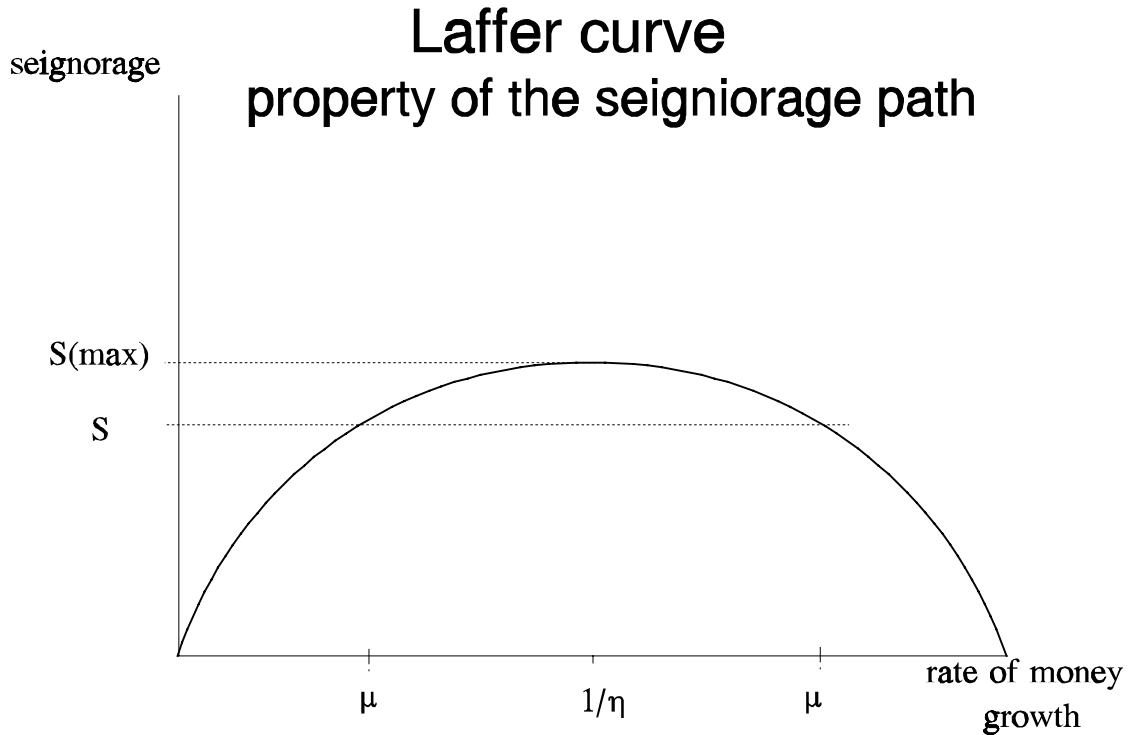
Against the left side of (2) another qualification may be raised. Do we estimate the real money demand or do the data reflect the supply of money? The identification problem is as old as the money demand function itself, or even older because it applies to any commodity¹³. For a transition economy the problem might seem even worse because the money market had to be influenced by an intensive credit rationing and other factors that make the identification of an appropriate function/curve more difficult. On the other hand, we work with differentials, which largely eliminate this problem and which are acceptable in the short-run analysis. Furthermore, we shall apply the instrumental variable procedure that helps to cope with simultaneity of money demand.

Keeping the nominal interest rate, or the real interest rate and the expected inflation, constant we differentiate (2) with respect to time to obtain the relation between the supply of money and inflation in the steady state. This derivative says that in the steady state money growth equals inflation plus the growth of output. Using this relation, we differentiate (1) where m is substituted by (2). Then we get

$$\frac{\partial S_Y}{\partial \mu} = (1 - \eta\mu)m = [1 - \eta(\pi + g)]m \quad (3)$$

where g is the rate of output growth. The equation (3) exhibits the Laffer curve property of the seigniorage path.

¹³ A classic article on this issue is E. Working (1927); see also Goldfeld, S.M. and D.E. Sichel (1990).



$S = S_Y$ is on the rising part of the locus if $\eta(\pi + g) < 1$ or, ignoring g , the product of inflation and interest semi-elasticity is less than 1. In other words, if inflation and interest elasticity are low, there is large room for increasing seigniorage revenue. The optimal, seigniorage maximizing rate of money growth with the preserved steady state is equal $1/\eta$. Beyond this point, the steady-state seigniorage falls.

To examine the relation between seigniorage and inflation or money growth we must estimate the money demand functions for a given country. We deal with this in Section 3.

3. Estimates of the Money Demand Function

In this part we deal with an estimation of our model, namely we apply the appropriate methods for the estimation of coefficients of the money demand function. We will pay special attention to the semi-elasticity of the demand for money because it is crucial for determining optimal money growth.

There are several problems in the estimation procedure that we have to cope with:

Small number of observations. We have data for the transition economies which represent at most four years; it turns out that we dispose - on a quarterly basis - with not more than 16 observations.

Seasonality. Working on the quarterly level one can point out that there might be a seasonality effect that can overwhelm information hidden in our data set. With respect to the small number of observations we cannot make any seasonal adjustment. Notice that the centered moving averages would introduce high autocorrelation and seasonal adjustments by applying quarterly dummies will lead to a substantial loss of freedom.

Common shocks. We have mentioned several times that there were common shocks that influenced the transforming economies. We have to distinguish these disturbances and separate them in the sense of 'setting up' the regression.

Note that the least-square estimator (of semi-elasticity) is biased because the model is simplified in the sense that the interest rate is considered as an exogenous variable, although the money supply and the interest rate are interrelated. This fact implies that we have to use an instrumental variable estimator. As instruments we suggest a constant term, the consumer price level or inflation, the growth of GDP (or industrial production) and/or the growth of disposable income (or wage bill)¹⁴.

In general form, we can work with an arranged equation (2). After taking logarithms and differentials we get¹⁵

$$\Delta \ln \frac{M}{P\Omega} = \varepsilon - \eta \Delta i + v$$

where v_t is a white noise process and ε corresponds to a drift of the random

¹⁴ With respect to the fact that the model is specified in the semi-log form, we may use the index of industrial production or of the wage bill because the growth rate for a given variable and its index must be the same.

¹⁵ We suppose that all variables are in the current period.

walk. We also assume unitary income elasticity; it is a standard assumption and, furthermore, a performed test did not enable us to reject this hypothesis.

Then, following the approach of instrumental variables, we can compute the estimator of the money demand function for the aforementioned countries, see Tables 4 and 5, respectively.

We also ran the regression for Bulgaria and Romania, but we did not obtain significant estimates for the available data (see Tables 3 and 4). Looking back at our discussion of the appropriateness of the model for the transition countries we can say that this suggests either a misspecification in the sense that there were other factors which crowded out the influence of the interest rate and/or the fact that we cannot work - at least for the time being - on the assumption that these economies behave as in the steady state.

We can find an explanation if we study a relationship between the interest rate, ΔIR and inflation, $INFL$ (or change of price level, ΔCPI) using their correlation coefficients. For comparison, we show the correlation matrices for the Czech Republic, Romania and Bulgaria below.

Table 3 The tightness between inflation and change of interest rate.

	Czech Republic (13 observations) ¹⁶	Romania (13 observations)	Bulgaria (9 observations) ¹⁷
	ΔIR	ΔIR	ΔIR
ΔCPI	0.871	0.029	-0.173
$INFL$	0.911	0.160	0.222

Looking at the correlation between ΔIR and ΔCPI (or $INFL$) it is not surprising that our model cannot work and that the regression procedure does not generate sensible results for Romania and Bulgaria. The assumption of

¹⁶ The critical levels of the correlation coefficient are: 0.441 at 10 %; 0.683 at 5 %; and 0.760 at 1 %.

¹⁷ The critical levels of the correlation coefficient are: 0.521 at 10 %; 0.602 at 5 %; and 0.735 at 1 %.

steady-state behavior is too restrictive for these countries; one can hardly take into account this assumption when the interest rate does not play a significant role in the money demand function. By and large, the model is inappropriate for Romania and Bulgaria, the behavior of variables is too shaky and does not enable us to separate the influence of the interest rate.

But the problems also remain for ‘well-behaved’ countries; we cannot be sure that the estimated coefficients are close to the ‘true’ values. A possible way of removing common seasonal (and another) shocks is the seemingly unrelated regression approach, which means that the money demand function for a set of countries will form a system of equations (solved again via the instrumental variable estimation procedure).

More precisely, there are two ways to solve a given equation:

- (1) to use instrumental variables corresponding only to a given country,
- (2) to employ a set of instruments (related to all considered countries) on a system of equations.

In general, the seemingly unrelated estimator approach (SURE) enables us to model random shocks that hit the region as a whole, but the (2) application also models a mutual influencing among countries. We have used the following instruments (13 observations):

a constant term, the growth of the Czech GDP or of the Czech disposable income, the index of Polish, Bulgaria and Romania industrial production, and the growth of wage bills of above mentioned countries.

The said procedures produce the results as follow (standard errors are in parathenses).

We can see (Table 4 and Table 5) that the coefficients have almost the same value as estimated above with the same, or slightly improved, statistics. This approach seems to be fruitful for improving the estimate when we work with a small sample, but it should be tested on a sample of more countries. In our case it does not change conclusions made on the base of the aforementioned results and we can use them for further analysis.

Table 4 The estimated parameters

	Parameter	Single equation	Simultaneous system (1)	Simultaneous system (2)
Czech Republic	ε	0.051 (0.027)	0.051 (0.025)	0.051 (0.025)
	η	-0.051 (0.017)	-0.051 (0.016)	-0.051 (0.016)
Poland	ε	-0.050 (0.031)	-0.049 (0.026)	-0.053 (0.029)
	η	-0.018 (0.005)	-0.016 (0.004)	-0.017 (0.007)
Bulgaria	ε	-0.0002 (0.150)	N/A	N/A
	η	-0.042 (0.035)	N/A	N/A
Romania	ε	-0.044 (0.140)	N/A	N/A
	η	-0.002 (0.0095)	N/A	N/A

Table 5 The corresponding statistics

	Statistics	Single equation	Simultaneous system (1)	Simultaneous system (2)
Czech Republic	R^2	0.40	0.396	0.396
	DW	2.27	2.274	2.276
Poland	R^2	0.64	0.639	0.639
	DW	2.08	2.18	2.13
Bulgaria	R^2	0.30	N/A	N/A
	DW	1.75	N/A	N/A
Romania	R^2	0.003	N/A	N/A
	DW	2.25	N/A	N/A

4. Optimal Money Growth with Respect to Seigniorage

In this chapter, we combine the exposition from Section 2 and the results from Section 3. We want to determine the seigniorage maximizing money

growth in the Czech Republic and compare it with the actual level of seigniorage. Other considered economies serve as reference countries and help us to better understanding the Czech economy during the transition period.

With the Czech interest semi-elasticity of demand for money about -0.05, the optimal money growth is approximately 20 percent. Supposing that the agents behave as in the steady state and taking into account actual inflation in 1993, which was slightly over 20 percent, we can conclude that the Czech inflation (money growth) is at, or close to, the optimal point. If the Czech authorities want to keep the economy on the steady-state path, they cannot increase money growth over this point - otherwise the seigniorage revenue would decrease (due to Laffer curve property) or the economy would lose the steady-state path.

From the point of view of seigniorage, the optimal revenue relative to GDP is around 2 percent.¹⁸ On the other hand, there is no evidence that the Czech government intends to use seigniorage as a source for its budget. Changes in the real monetary base are a consequence of the attitude to monetary policy. The government has made a commitment to finance its expenditures from taxes and from temporary privatization yields rather than from money printing.

Looking at the estimates in Poland, the situation is not dramatically different. The difference is that Poland has been living with higher inflation so that its steady-state rates of inflation and of money growth are higher than in the Czech Republic. This is reflected in lower interest semi-elasticities and a higher seigniorage maximizing monetary growth. It takes some time before the agents have adjusted to an inflationary environment, but then it is difficult to lower the steady-state inflation. The one-blow therapy is possible only when the policy is sufficiently credible, otherwise the situation can be worse.¹⁹

This argument holds even more for Romania and Bulgaria. They are obviously out of the steady-state path or they do not behave as though they were on it. Thus, the steady-state model is completely inappropriate for these two economies in the considered period. One can hardly expect 'normal' behavior in an economy where the real interest rate is largely negative like in Romania. The position of the Bulgarian economy is similar, though less extreme. In these countries, an analysis of the exchange rate volatility would be more fruitful, but it goes beyond our model and beyond the scope of this paper.

¹⁸ We work with the estimate of M0 by Izak and Klokocnik (1993); M0 is estimated over Kc 100 bn whilst the nominal GDP in 1993 was over Kc 1000 bn, so $m \approx 0.1$.

¹⁹ See the study by Flores, Monteiro, Szafarz (1994) which compares the Polish and Brazilian case.

5. General Truth and Implications of the Analysis.

- (1) It is generally accepted that one of the most urgent dangers in the transition economy is inflation. To curb prices in the highly inflationary environment requires a strict monetary stance accompanied by appropriate measures in the fiscal and income policies. The evidence as well as common wisdom suggests that the sustainability of stabilizing policies is undermined by the government's credibility. Any economy in transition undergoes various shocks, either induced by the transition itself or by external disturbances, and hence it must look for a stabilizing anchor.

Only the Czech economy could afford the nominal exchange rate as the anchor because the initial disequilibria, and consequent inflation, were relatively small. In more inflationary countries, this policy cannot succeed because rising domestic prices destroy the country's competitiveness.

- (2) Governments in all the discussed countries are aware that money printing will not lead to a successful transformation of the economy. Some of them, however, face huge budget deficits, partially due to a severe recession and partially due to the lack of political consensus (and low credibility). Thus, inflation remains a serious problem in these economies, especially in Romania and Bulgaria where getting inflation under control will be extremely difficult.
- (3) The econometric analysis verifies the intuitive view that the Czech Republic and Poland²⁰ are most stable from the Central and East European transforming economies. We can even argue that a steady-state model can be - with caginess - applied and interpreted. The argument is based on the fact that these economies behave as if in the steady state or, at least, some aspects can be analyzed from the point of view of a steady-state model.
- (4) The analysis shows that the Czech economy tends not to be inflationary. That is, there is a narrow space for seigniorage revenue assuming that the

²⁰ Hungary and perhaps Slovakia belong to these two but due to - the above mentioned - unavailability of data we could not perform the analysis also for them.

government strives to keep the economy on the steady-state path. The results indicate that the Czech seigniorage maximizing steady-state inflation is around 20 percent. It implies that the optimal (maximum) seigniorage is approximately 2 percent of GDP. On the other hand, the observer is aware of the fact that seigniorage revenue is not a budget source *per se*, but it is determined by other monetary targets.

- (5) A crucial part of the analysis is the estimation of the money demand function. The analysis points to an important fact that the interest rate has started playing its role in the economy in spite of the influence of other measures which had been applied by the authorities in the transition process. The interplay of the money supply and the interest rate will be exciting to study in the coming process of widening the convertibility of the Czech crown. But it is out of the framework of the analysis presented here.

References

- Alogoskoufis, S. and N. Christodoulakis, "Fiscal Deficits, Seigniorage and External Debt: The Case of Greece", Discussion Paper #468, Sep. 1990, CEPR.
- Blanchard, O. J. and Fischer, S., *Lectures on Macroeconomics*, MIT Press, 1989.
- Bulgarian National Bank, reports.
- Bulgarian Agency for Economic Coordination and Development, business surveys.
- Burda and Ch. Wyplosz, *Macroeconomics: A European Text*, Oxford Press, 1993.
- Ceska, R., "Three Years of Privatization in the Czech and Slovak Republics", Privatization Newsletter of the Czech Republic and Slovakia 2, No. 17, 1993, pp. 1-5.
- Coats, W., Bank Review: "Market-based Monetary Control", Quarterly Journal, 4/1992.
- Czech Statistical Office, reports.
- Czech National Bank, reports.
- Flores, Monteiro and Szafarz, A.C.E. project on Econometric Inference into the Macroeconomic Dynamics of East European Economies, University of Leicester, working paper (forthcoming).
- Frenkel, A. and A. Razin, "Fiscal Policies and the World Economy", 1987.
- Goldfeld, S.M. and D.E. Sichel, "The Demand for Money", in Friedman, B.M. and F.H. Hahn, *Handbook of Monetary Economics*, North-Holland, 1990.
- Hanousek, J. and Z. Tuma, "Konstrukce makroekonomického modelu pro českou ekonomiku", Finance a uver no. 1, 1994.
- International Financial Statistics.
- Izak, V. and O. Klokocnik, Monetary Policy during the Transformation Process, Discussion paper no. 13, CERGE, Prague, Nov 1993.

- Kamenickova, V., P. Stepanek, and D. Vaskova, "Fiscal Policy in Czechoslovakia", presented at a conference of the Institute for East-West Studies, Nov. 1992.
- Laki, M., "Hungarian Survey", in Winiecki, J. and A. Kondratowicz, (eds.), *The Macroeconomics of Transition: Developments in East Central Europe*. Routledge, London, 1993.
- National Centre for Information of the Czech Republic (NIS), reports.
- Nenova, M., "The 1991 Budget and Some Policy Implications for 1992", Agency for Economic Coordination and Development, March 1992, Sofia.
- OECD Bulletins.
- The Institute for EastWest Studies' Conference, Warsaw, April 1993.
- Winiecki, J., "The Regional Survey", in Winiecki, J., and A. Kondratowicz (eds.), *The Macroeconomics of Transition: Developments in East Central Europe*. Routledge, London, 1993.
- Working, E. (1927), "What Do Statistical Demand Curves Show", reprinted in Stigler, G.J. and K.E. Boulding (eds.), *Reading in Price Theory*, London: Allen and Unwin, 1953.
- Zielinski, M., Polish Survey, in Winiecki, J. and A. Kondratowicz (eds.), *The Macroeconomics of Transition: Developments in East Central Europe*. Routledge, London, 1993.